

SHORT COMMUNICATION

Treatment of hybrid taxa on the census of Western Australian plants

Hybrids are important components of plant biodiversity (Rieseberg & Wendel 1993) and some hybrids are recognisable entities that may play a role in evolution and biological interactions (Soltis & Soltis 2009). Hybrids vary from stabilised, morphologically consistent, true-breeding, easily recognisable taxonomic entities, to complex, highly variable assemblages (hybrid swarms) occupying the morphological and geographical boundaries between existing species, to occasional sterile F1 hybrids (Hopper 1996).

At the Western Australian Herbarium (PERTH), hybrid names may be included in the state plant census database (WACENSUS) and/or they may be used on specimen labels (and entered into the specimen database WAHERB). If a hybrid name is included in WACENSUS, the entity will appear online in *FloraBase* (Western Australian Herbarium 1998–). Hybrid specimens which do not have a name entry in WACENSUS will not appear in *FloraBase* and hence will be invisible to our users, except by directly querying specimens. The practical long-term purpose of including at least some hybrids on WACENSUS (and hence in *FloraBase*) is to inform users of significant hybrid entities in the Western Australian flora.

Hybrids (with the exception of nothotaxa) have not been treated consistently at PERTH in the past. Variable proportions of hybrids have been entered onto WACENSUS in different taxonomic groups, with no clear policy direction as to the circumstances for the entry of hybrid names; in most groups, there is no clear reason why some hybrid names have been added to WACENSUS while others have not. This paper outlines the agreed policy at PERTH regarding hybrid names.

Nomenclatural designation of hybrids

Nomenclaturally, two types of hybrid names may be designated under the *International Code of Nomenclature for algae, fungi and plants* (ICN; McNeill *et al.* 2012): nothotaxa (hybrids with an epithet) and hybrid formulae.

Nothotaxa are named hybrids between representatives of two or more taxa. For nomenclatural purposes, the hybrid nature of such a taxon is indicated by placing the multiplication sign \times before the name of an intergeneric hybrid (e.g. \times *Cyanthera*) or before the epithet in the name of an interspecific hybrid (e.g. *Elythranthera* \times *intermedia* (Fitzg.) M.A.Clem.), or by prefixing the term ‘notho-’ (optionally abbreviated ‘n-’) to the term denoting the rank of the taxon (see ICN Art. 3.2 and 4.4). Nothotaxa are equivalent to published taxon names in that they have an author, publication, etc. and are nomenclaturally controlled under the ICN.

A hybrid formula allows designation of hybrid status by inserting a multiplication sign between the names of the parent taxa (e.g. *Eucalyptus macrocarpa* Hook. \times *E. pyriformis* Turcz.). Epithets in a hybrid formula should be placed in alphabetical order (Art. H.2A.1). The multiplication sign is placed between, and separate from, the names of the parents (Art. H.3A.1). Hybrid formulae are not controlled under the ICN and hence are not regarded as equivalent to published taxon names (Art. 23.6(d)).

Conservation assessment of hybrids

The Department of Parks and Wildlife's Species and Communities Branch has the following guidelines for accepting a hybrid population as a conservation taxon (Department of Conservation and Land Management 1998):

1. it must be a distinct entity, that is, the progeny are consistent within the agreed taxonomic limits for that taxonomic group;
2. it must be capable of being self-perpetuating, that is, not reliant on the parent stock for replacement; and
3. it must be the product of a natural event, that is, both parents were/are naturally occurring and cross fertilization was by natural means.

Criteria for establishing hybrid status

It is often difficult to determine if a given specimen or population is a hybrid, or merely a variant of a taxon. Hybridisation is often inferred or suspected from the pattern of variation observed in nature or from herbarium specimens, and is rarely known with certainty; hybridity can often only be determined absolutely using either breeding experiments or through detailed genetic assessment.

This policy does not attempt to establish criteria which must be met for an assumption of hybridity to be accepted. However, authors of taxonomic treatments associated with PERTH are encouraged to consider the following before publishing a nothotaxon or hybrid formula:

1. is the hybridisation a natural event?;
2. are the hybrids fertile or sterile?;
3. are the hybrids common and likely to be encountered in the wild, or rare and insignificant?;
4. are the hybrid progeny highly variable (e.g. through segregation) or morphologically relatively uniform?; and
5. are the hybrids self-perpetuating, or do they rely on repeated hybridisation events from the parents for maintenance?

In general, authors are encouraged to not publish nothotaxa or hybrid formulae in cases where the hybrids are sterile, do not form significant, recognisable populations, and/or where there is evidence that they are not self-perpetuating.

Policy

The following will be included on WACENSUS:

1. validly published nothotaxa;
2. hybrid formulae published in a taxonomic treatment as the equivalent of a taxon, that is, with the hybrid formula clearly stated and with a description, conservation status, notes

on distribution, variation and diagnostic features (particularly means of discriminating the hybrids from the parents), specimens cited, etc.;

3. hybrids that were originally included as non-hybrid taxa before their hybrid status was determined or inferred; in these cases, the entity will be retained as a nothotaxon on WACENSUS on a case by case basis, taking into account the hybrid entity's status in the wild and whether it is self-perpetuating; and
4. hybrid weeds not qualifying as above but where the hybrid is the only representative in Western Australia of that entity.

The following will not be included on WACENSUS:

5. hybrid names used on specimen labels or in unpublished literature;
6. hybrids mentioned in published literature where the requirements of (2) above are not met (for example, notes under a treated species that it occasionally hybridises with one or more other species, forms a hybrid swarm or intergrades with another species etc., but does not treat the hybrid under a specific heading using a specific hybrid formula);
7. hybrid formulae merely listed in a publication without meeting the requirements of (2) above; and
8. hybrids that have been created through artificial means, unless these are established in naturalised populations.

Note that this policy will be applied retroactively, with non-qualifying hybrid formulae removed from WACENSUS over time, on a case-by-case basis.

Acknowledgements

Members of the Western Australian Herbarium's Taxonomic Review Committee are acknowledged for helpful discussions and meaningful contributions to the drafting of this policy. Brendan Lepschi provided useful comments on the manuscript.

References

- Department of Conservation and Land Management (1998). *The listing of hybrids as threatened species: proceedings and recommendations of a workshop held at Kings Park and Botanic Garden, 30th July 1998*. (Department of Conservation and Land Management: Como, Western Australia.)
- Hopper, S.D. (1996). Evolutionary networks: natural hybridization and its conservation significance. In: Saunders, D.A. Craig, J.L. & Matiske, E.M. (eds) *Nature conservation 4: the role of networks*. pp. 51–63. (Surrey Beatty & Sons Pty Limited: New South Wales.)
- McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Prud'homme van Reine, W.F., Smith, G.F., Wiersema, J.H. & Turland, N.J. (eds) (2012). *International Code of Nomenclature for algae, fungi, and plants (Melbourne Code), adopted by the eighteenth International Botanical Congress Melbourne, Australia, July 2011*. Regnum Vegetabile 154. (Koeltz Scientific: Königstein, Germany.)
- Rieseberg, L.H. & Wendel, J.F. (1993). Introgression and its consequences in plants. In: Harrison, R.G. (ed.) *Hybrid zones and the evolutionary process*. pp. 70–109. (Oxford University Press: New York.)

Soltis, P.S. & Soltis, D.E. (2009). The role of hybridization in plant speciation. *Annual Review of Plant Biology* 60: 561–588.
Western Australian Herbarium (1998–). *FloraBase—the Western Australian Flora*. Department of Parks and Wildlife. <http://florabase.dpaw.wa.gov.au/> [accessed 3 November 2014].

Kevin R. Thiele¹ and Cheryl M. Parker^{1,2}

¹Western Australian Herbarium, Department of Parks and Wildlife,
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

²Corresponding author, email: cheryl.parker@dpaw.wa.gov.au